## REMARKS

Claims 1-6 and 10-18 are pending in the present application. Claims 1, 11 and 14 are herein amended. Claims 7-9 are canceled.

### Allowable Subject Matter

Claims 11-13 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 11 has been amended into independent form to recite all of the limitations of base claim 1.

Withdrawal of the objection to claims 11-13 is requested.

### Claim Rejections – 35 U.S.C. §§ 102 and 103

#### A. Rejections based on Okumura

Claims 1 and 4-9 were rejected under 35 U.S.C. § 102(b) as being anticipated by **Okumura** (US 2003/0066958); claims 2 and 3 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Okumura** in view of **Bier** (US 5,420,425); and claim 10 was rejected under 35 U.S.C. § 103(a) as being unpatentable over **Okumura** in view of **Frazen** (US 6,700,117).

Favorable reconsideration is requested.

Claim 1 is amended to include "a set of voltage supplies to provide only discrete DC levels." The invention as recited in claim 1 uses a set of voltage supplies to provide only discrete DC levels. It means that claim 1 does not include supplies to provide AC or RF voltages.

Claim 1 is also amended to recite that "all the trapped ions in the ion trap are ejected from said ion trap ~~towards~~ along the flight path to said time-of-flight mass spectrometer." This amendment restricts the constitution of claim 1 to exclude a pulsar (refer to Fig. 5).

**(1)** Applicants respectfully submit that Okumura does not teach or suggest "a set of voltage supplies to provide only discrete DC levels" as recited in amended claim 1. Okumura discloses using an AC power supply. Thus, claim 1 is structurally distinguishable from Okumura.

**(2)** Applicants respectfully submit that Okumura does not teach or suggest that "all the trapped ions in the ion trap are ejected from said ion trap ~~towards~~ along the flight path to said time-of-flight mass spectrometer" as recited in amended claim 1. Okumura necessarily includes a pulsar, and thus amended claim 1 is structurally distinguishable from Okumura.

The invention as recited in claim 1 does not include a pulsar and directly ejects the ions from the ion trap to TOF mass analyzer. Mass measurement in a TOF mass analyzer is based on the flight time of ions to arrive at the detector. In order to improve the resolution of a TOF mass measurement, it is essential to reduce the velocity spread and the spatial spread of the ions in the ion trap because the velocity spread and the spatial spread affect the time of flight of the ions. RF voltage used in trapping ions in an ion trap results in residual ringing RF in the trapping region after switching off the RF voltage (0003). The ringing RF voltage increases the spread of the ions. Thus, the present invention does not use RF voltage but uses discrete levels of DC voltage to trap ions.

In contrast, Okumura ejects the ions in the ion trap through the orthogonal accelerator 18 (pulsar) to the TOF mass analyzer. The spatial spread in the direction of ejecting from the ion

trap has little influence on the time of flight in the TOF mass analyzer because of the mediating effect of the pulsar. Thus, the performance of the TOF mass analyzer is not significantly affected even if the spatial spread in the ion trap is increased by the use of RF voltage. Nevertheless, Okumura also intends to decrease the spatial spread of the ions because too broad of a spread requires a long detector.

Okumura accumulates the ions in the pulsar and then ejects the accumulated ions toward the TOF mass analyzer. The ions which are accelerated to the detector of the TOF mass analyzer are only those ions that exist in the acceleration region in the pulsar when an acceleration voltage is applied (0017). In order to broaden the mass-to-charge ratio range of the ions accumulated in the acceleration region of the pulsar, means for reducing the velocity spread of the ions entering the acceleration region should be provided (0018, refer to Fig. 5). The present invention, however, does not have this problem because the ions are directly ejected from the ion trap to the TOF mass analyzer and accordingly the ions of broad mass-to-charge ratio range already exist in the acceleration region.

In addition, the present invention as recited in the claims, uses a linear ion trap; on the other hand Okumura uses a 3-D ion trap. Okumura describes that the invention is also applicable to the linear ion trap, which is not convincing. Although a 3-D ion trap has a space focal plane of the ions in the central point of the ion trap, a linear ion trap has a space focal plane of the ions along the line on the axis of the linear ion trap. The different configuration of the ion trap results in the different distribution of the ions. It is expected that a different distribution of ions may need a different way of controlling the distribution.

**B. Rejection based on Bateman**

Claims 14-18 were rejected under 35 U.S.C. § 102(b) as being anticipated by **Bateman** (US 2004/0026613). Favorable reconsideration is requested.

**(1)** Applicants respectfully submit that Bateman does not teach or suggest "A method of extracting ions from a linear ion trap" as recited in claim 14.

An ion trap is one in which ions are trapped for some time and focused near the central area by applying voltages on the electrodes of the ion trap. Bateman describes that the trapping regions in the ion guide 1 are translated along the ion guide (0119) and that the ions in the ion guide travel along the axis of the ion guide (refer to Fig. 3). It thus follows that the ion guide 1 is for controlling the movement of the ions, not for trapping the ions for some time. That is, the ion guide 1 is not an ion trap and Bateman does not teach the method of extracting ions from a linear ion trap.

**(2)** Applicants respectfully submit that Bateman does not teach or suggest "trapping said ions in said ion trap by switching <u>fast</u> between a set of trapping states defined by <u>discrete DC levels applied</u> on the electrodes of said ion trap" as recited in amended claim 14.

The invention as recited in claim 14 is about the step of trapping the ions in the ion trap by switching fast between a set of trapping states defined by discrete DC levels applied on the electrodes of said ion trap. The way to switch between a set of trapping states is shown in Fig. 6.

Bateman applies transient DC voltages on certain electrodes of the ion guide so that potential wells are formed between these electrodes. The transient DC voltages are then progressively applied to subsequent electrodes so that the trapping regions move along the ion

guide (0126). That is, Bateman does not switch the voltage on the electrodes between discrete DC levels.

**(3)** Applicants respectfully submit that Bateman does not teach or suggest "switching from a pre-selected trapping state to a final ejection state in condition of pure electrostatic field within the ion trap in a pre-selected time by elongating the switching period of the trapping states" as recited in claim 14.

The invention as recited in claim 14 traps the ions by switching fast the voltage on the electrodes between discrete DC levels and ejects the ions from the ion trap by elongating the period of switching the voltage on the electrode (refer to Fig. 6).

Bateman describes how the ions are pushed out of the ion guide 1 in paragraph (0199) ("When the first potential well ... reaches the end of the travelling wave ion guide 1 the front potential barrier disappears and the rear potential barrier pushes the ions out of the travelling wave ion guide 1"). The ejection state in Bateman is not caused by elongating the switching period of the trapping states.

The present invention is also distinguished from Bateman in terms of the voltages applied to the electrodes of the ion trap. The present invention does not use RF voltage for trapping or ejecting the ions, while Bateman uses RF voltages applied on the exit group of electrodes (0182, 0187).

For at least the foregoing reasons, claims 1-6 and 10-18 are patentable over the cited references. Accordingly, withdrawal of the rejection of claims 1-6, 10 and 14-18 is hereby solicited.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,
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